

WHAT IS CLAIMED IS:

1. A voltage sensing circuit comprising:
 - a bandgap generator generating an internal voltage and a bandgap voltage;
 - a monitoring unit monitoring the internal voltage of the bandgap generator, thereby determining whether the bandgap generator is adequately powered; and
 - a voltage comparator comparing a voltage to be sensed with the bandgap voltage, or with a reference voltage derived from the bandgap voltage, thereby generating a sensing signal; wherein
 - the monitoring unit outputs a signal that forces the voltage comparator to set the sensing signal to a fixed state when the bandgap generator is inadequately powered.
2. The voltage sensing circuit of claim 1, wherein the fixed state indicates that the voltage to be sensed is at an unsatisfactory level.
3. The voltage sensing circuit of claim 1, wherein the voltage comparator includes a transistor having a conductivity controlled by the signal output by the monitoring unit.
4. The voltage sensing circuit of claim 1, wherein the bandgap generator conducts an internal current from which the internal voltage is generated, and the monitoring unit includes:
 - a voltage generator for generating an internal reference voltage by mirroring the internal current of the bandgap current; and
 - a comparator for comparing the internal voltage of the bandgap generator with the internal reference voltage.

5. The voltage sensing circuit of claim 1, wherein the voltage comparator compares the voltage to be sensed with said reference voltage derived from the bandgap voltage, further comprising a reference voltage generator for generating the reference voltage, the reference voltage including:

- a first differential amplifier having a first input terminal, a second input terminal, and an output terminal, receiving the bandgap voltage at the first input terminal and generating an amplified bandgap voltage at the output terminal;

- a first resistor; and

- a first transistor having a conductivity controlled by the amplified bandgap voltage, the first transistor supplying current to the first resistor, thereby generating said reference voltage and a feedback voltage, the feedback voltage being fed back to the second input terminal of the first differential amplifier.

6. The voltage sensing circuit of claim 5, wherein the bandgap generator generates an internal bias current from which the bandgap voltage is generated, the first differential amplifier includes a current source, and the reference voltage generator also includes:

- a bias circuit mirroring the internal bias current of the bandgap generator, thereby generating a first bias voltage, and supplying the first bias voltage to the first differential amplifier to control the current source in the first differential amplifier; and

- a compensation circuit for compensating for voltage offset in the first differential amplifier due to variation of the first bias voltage.

7. The voltage sensing circuit of claim 6, wherein the reference voltage generator also includes a second resistor connected in series with the first resistor, the reference voltage being obtained from a point at which the first and second resistors are interconnected, the feedback voltage being obtained from a point at which the first transistor and the first resistor are interconnected.

8. The voltage sensing circuit of claim 7, wherein the compensation circuit comprises:

- a second transistor having a conductivity controlled by the amplified bandgap voltage;

- a third transistor connected in series with the second transistor, having a conductivity controlled by the first bias voltage, producing a second bias voltage at a point at which the second and third transistors are interconnected;

- a fourth transistor connected in parallel with the third transistor, having a conductivity controlled by the second bias voltage;

- a fifth transistor connected in parallel with the first and second resistors, having a conductivity controlled by the first bias voltage, for reducing current flow through the first and second resistors; and

- a sixth transistor connected in parallel with the current source in the first differential amplifier, having a conductivity controlled by the second bias voltage, for augmenting current flow through the first differential amplifier.

9. The voltage sensing circuit of claim 8, wherein the voltage comparator includes:

- a shifting circuit for shifting the voltage to be sensed according to the second bias voltage; and

- a second differential amplifier conducting a current

determined by the second bias voltage, for comparing the shifted voltage with the reference voltage.

10. The voltage sensing circuit of claim 8, wherein the reference voltage generator also includes a seventh transistor having a conductivity controlled by the second bias voltage, for generating a third bias voltage, and the monitoring unit includes:

- a shifting circuit for shifting the voltage to be sensed according to the third bias voltage; and

- a second differential amplifier conducting a current determined by the second bias voltage, for comparing the shifted voltage with the reference voltage.

11. The voltage sensing circuit of claim 1, wherein the bandgap generator comprises:

- a bandgap current generator generating an internal current and a voltage signal; and

- a feedback circuit amplifying and inverting the voltage signal generated by the bandgap current generator and feeding the amplified and inverted voltage signal back to the bandgap current generator.

12. The voltage sensing circuit of claim 11, wherein the voltage signal generated by the bandgap current generator is the internal voltage monitored by the monitoring unit.

13. The voltage sensing circuit of claim 1, wherein the voltage sensing circuit is formed on a substrate and the voltage to be sensed is a voltage of the substrate.

14. The voltage sensing circuit of claim 1, wherein the voltage sensing circuit is disposed in an integrated circuit and the voltage to be sensed is generated in the integrated

circuit.

15. The voltage sensing circuit of claim 1, wherein the voltage to be sensed is a power supply voltage.

16. The voltage sensing circuit of claim 15, further comprising:

a voltage generator using resistors to divide the power supply voltage, thereby generating a first voltage and a second voltage lower than the first voltage;

a switching circuit controlled by the monitoring unit to select the bandgap voltage when the bandgap generator is adequately powered and the first voltage when the bandgap generator is inadequately powered; wherein

the monitoring unit compares the internal voltage of the bandgap generator with the first voltage; and

the voltage comparator compares the second voltage with the voltage selected by the switching circuit.

17. The voltage sensing circuit of claim 16, wherein the voltage comparator includes a transistor controlled by the monitoring unit to halt current flow through the voltage comparator when the bandgap generator is inadequately powered.

18. The voltage sensing circuit of claim 15, further comprising:

a voltage generator using resistors to divide the power supply voltage, thereby generating a first voltage, a second voltage lower than the first voltage, and a third voltage lower than the second voltage; and

a switching circuit controlled by the monitoring unit to select the bandgap voltage when the bandgap generator is adequately powered and the first voltage when the bandgap

generator is inadequately powered; wherein

the monitoring unit compares the internal voltage of the bandgap generator with the first voltage; and

the voltage comparator compares both the second and third voltages with the voltage selected by the switching circuit, thereby providing hysteresis in the sensing signal.

19. The voltage sensing circuit of claim 18, wherein the voltage comparator comprises:

a first comparator comparing the second voltage with the voltage selected by the switching circuit to generate a reset signal;

a second comparator comparing the third voltage with the voltage selected by the switching circuit to generate a set signal; and

a flip-flop set by the set signal and reset by the reset signal, for outputting the sensing signal.

20. The voltage sensing circuit of claim 19, wherein the first comparator and the second comparator include respective transistors controlled by the monitoring unit to halt current flow through the first comparator and the second comparator when the bandgap generator is inadequately powered.